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AUTHOR Letcher, Lisa M.; And Others
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ABSTRACT

The longitudinal study compared the speech of two children (beginning at age 3) with cleft palate and inadequate velopharyngeal closure in an attempt to identify the patterns of production observed prior to surgery and the course and rate of change in production following surgery. Subjects' speech samples were evaluated prior to pharyngeal flap surgery, 1 month after surgery, and at 3-month intervals until their speech was age appropriate. Analysis of pre- and post-surgery samples revealed that both subjects displayed similar patterns of substitutions prior to surgery and that their speech production became more variable after surgery, perhaps reflecting exploration of their newly revised speech mechanism. Findings suggested that change following surgery takes time and that accurate speech sound production may not result until nearly a year after surgery. (CL)

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A Longitudinal Study: Phonological Changes with Pharyngeal Flap Surgery

Lisa M. Letcher
Patricia A. Broen
Karlind T. Moller
University of Minnesota

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Paper presented at the annual convention of the American Speech-Language-Hearing Association, Detroit, 1986.

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A Longitudinal Study: Phonological Changes Associated with Pharyngeal Flap Surgery

Lisa M. Letcher Patricia A. Broen Karlind T. Moller
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Paper presented at the annual convention of the American Speech-Language-Hearing Association, Detroit, 1986.

This study examined the speech of two children with cleft palate and inadequate velopharyngeal closure from prior to pharyngeal flap surgery to the point where they had age appropriate speech. The data are part of an ongoing, longitudinal study of a larger sample of children with cleft palate and inadequate velopharyngeal closure.

Children with cleft palate who have inadequate velopharyngeal closure after primary palatoplasty learn to speak without being able to effectively separate the oral cavity from the nasal cavity. It is usually the case that these children undergo either secondary palatal surgery or some form of prosthetic management when it is clear that they cannot obtain velopharyngeal closure. The literature suggests that, prior to that time, these children often adopt maladaptive patterns of articulation that have been described as "compensatory" or "posterior," but little documentation or description of the phonological structure of those patterns is available and we know almost nothing about the course of change following structural management. Such information is necessary when decisions are being made regarding the timing and appropriateness of surgery or of speech therapy following surgical or prosthetic intervention.

This longitudinal study compares the speech of two children with cleft palate and inadequate velopharyngeal closure in an attempt to identify 1) the patterns of production observed prior to surgery and 2) the course and rate of change in production following surgery.

METHOD

Two children, a 3 year 10 month old female and a 3 year, 7 month old male, were seen individually during the month prior to pharyngeal flap surgery, one month after surgery, and at three-month intervals until their speech was age appropriate. In addition, they were recalled to obtain current speech production information. Subject 1 was 15 months post surgery, Subject 2 was 33 months post surgery at the time of the recall. Both children have received 2 to 8 months of speech therapy both before and after pharyngeal flap surgery.

Both children had unilateral complete clefts of the lip and palate. Speech production samples were video and audio recorded at each session. When information was available, tympanograms and pure tone screenings were within normal limits in at least one ear for both children.

Speech Sample

The following three speech samples were obtained during each visit; (a) a 10-minute play sample with a parent, (b) a structured play session with the experimenter, and (c) the child's imitation of a set of CVC words in which each consonant occurred three times word initially and three times word finally. Productions were transcribed by the examiner who interacted with the child, using a modification of IPA (Kittelson, Broen, & Moller, 1983) that included diacritic markings proposed by Shriberg and Kent (1982) and some special symbols designed for use with children with cleft palate. In this paper, we will examine the child's imitative productions of word initial and word final phonemes.

Reliability

Ten percent of the sample was transcribed by a second transcriber. Agreement on voicing, and place and manner of articulation between the initial transcriber and a second judge was over 90%.

Analysis

In analyzing the children's production, certain classifications decisions were made that affect the interpretation of the data. Following Chomsky and Halle (1968), the feature [sonorant] is defined as not only nasal stops, liquids, and the glides /w/ and /j/, but also the phonemes Chomsky calls Class II glides, /h/ and /ʔ/. In addition, following Ladefoged (1982), the phoneme /h/ was considered to be a voiceless onset to the following vowel, with no unique place of articulation.

RESULTS

Overall Error Rates

Prior to surgery, both subjects exhibited a high percentage of errors in word initial position (Figure 1). Subject 1 had a 75% error rate. She appeared to substitute [nasal] consonants with the appropriate place of articulation for all [obstruent] consonants, that is, for stops, fricatives, and affricates. Therefore, she did not produce a contrast between voiced and voiceless consonants nor did she produce a contrast between stop consonants and fricative consonants word initially.

Subject 2 had an error rate of about 56% word initially and honored the contrast between voiced and voiceless consonants, often substituting /h/ or a nasalized version of the correct consonant for voiceless sounds and a nasal or glide for voiced sounds.

One month after surgery, the overall error rate for both children was still high. They did not immediately produce accurate, well articulated speech. Child 1 required 7 months to achieve age appropriate speech, Child 2 required, 10 months.

Word finally, Subject 1 made fewer errors than word initially (Figure 2). Only 27% of her production were in errorand the errors she made were not typical

of children with cleft palate. Her error rate word finally was also much slower to change and even at recall, over a year after surgery, her production of word-final consonants in imitated CVC words was not completely accurate. Prior to surgery, Subject 2 made errors in the production of 60% of the consonants and the error patterns he displayed were similar to those observed word initially. The accuracy of his word final consonant productions impoved gradually over the 10 months following surgery. By the time he was recalled, all word final consonants in single syllable words were produced correctly.

Sonorant Substitutions

If the production errors of these two children are examined at a more abstract level, both of these children tend to substitute [sonorant] consonants for [obstruent] consonants both word initally and word finally. Sonorant consonants do not require increased intraloral pressure for their production.

Looking specifically at the percentage of errors that were [sonorant] substitutions, we see a more dramatic change following surgery. Presurgically, 93% of Subject 1's errors and 62% of Subject 2's errors involved the substitution of a sonorant for an obstruent (Figure 3). One month after surgery, the rate of sonorant substitution errors was cut in half and by 4 months, almost none of the errors produced by either child, word initially, could be described as [sonorant] substitution errors.

Word finally, only Subject 2 displayed the strong [sonorant] substitution pattern (Figure 4). Prior to pharyngeal flap surgery, Subject 1's final consonant errors did not typically involve the substitution of a [sonorant] for an [obstruent] and therefore did not display the rapid decrease of [sonorant] substitutions. In fact, Subject 1 exhibited a slight increase in the frequency of word final [sonorant] substitutions one month post surgery. This disappeared by 4 months post surgery.

Index of Variability

Children's production of speech is not accurate immediately after pharyngeal flap surgery but it improves over a period of months following surgery. This pattern of change is consistent with the concept of the child as an active participant in the acquisition process. It is consistent with the position that the child is actively trying to sound like others and that the pattern of speech observed in the child with inadequate velopharyngeal closure is the result of these active attempts. If this is the case, then it seems reasonable to look for a period of disequilibrium following surgery. The child is now capable of producing sounds that couldn't be produced prior to surgery. During this time the child might be activly exploring the new ability to poduce speech. To assess this hypothesis, an index of variability was developed where the number 1 indicates that only one consonant was used for all three attempts at producing a particular consonant, a 2 indicates that, in three attempts, two different consonants were produced, and a 3 indicates that each of the three attempts at producing a particular consonant was different.

As you can see (Figure 5), word initially, variability does increase following surgery, suggesting a period of exploration or disequalibrium. As productions become more accurate, variability decreases.

Word finally (Figure 6), this same pattern was exhibited by Subject 2.

Subject 1, however, did not become more variable in the production of word-final consonants following surgery. Subject 1 had a low error rate on word final consonants prior to surgery, with errors that generally did not involve the substitution of [sonorant] consonants for [obstruent] consonants. Her production of word-final consonants did not improve markedly after surgery.

DISCUSSION

These two children displayed different patterns of articulation prior to sugery but they both displayed patterns that can be described as the substitution of [sonorant] consonants for [obstruent] consonants, word initially and one child displayed this kind of pattern word finally. Following surgery, the productions of the children became more variable in that they tended to produce more different consonants for each consonant suggesting that they were exploring the capabilities of their newly revised speech mechanism. The only exception to this pattern was Subject 1's production of word-final consonants. Here the base error rate was low, the substitution pattern did not involve increased use of [sonorant] consonants, variability did not increase following surgery, and productions did not tend to become correct over time.

This paper is based on the performance of only two children from our larger sample. These were the first two children to achieve age appropriate speech, so they may not be typical. They do suggest, however, that change following surgery takes time and that the effectiveness of surgery may not be reflected in accurate speech sound production until almost a year after surgery. Within a relatively short period of time there was a decrease in the frequency of [sonorant] substitutions for [obstruent] consonants. In these children, that particular error pattern had decreased substantially by 4 months post surgery.

This pair of children also raise some interesting questions about the timing of therapy following surgery. It may be that more can be accomplished by taking advantage of the increased variability in production that occurs immediately after surgery. The child may benifit more from direct intervention during those first few months when the child's phonological system is in flux. On the other hand, one might argue that it is reasonable to wait for a year following surgery to allow the change that the child will make on his/her own to be completed before initiating therapy. Some studies of the efficacy of intervention at various times post surgery might help to answer that question.

ACKNOWLEDGEMENTS

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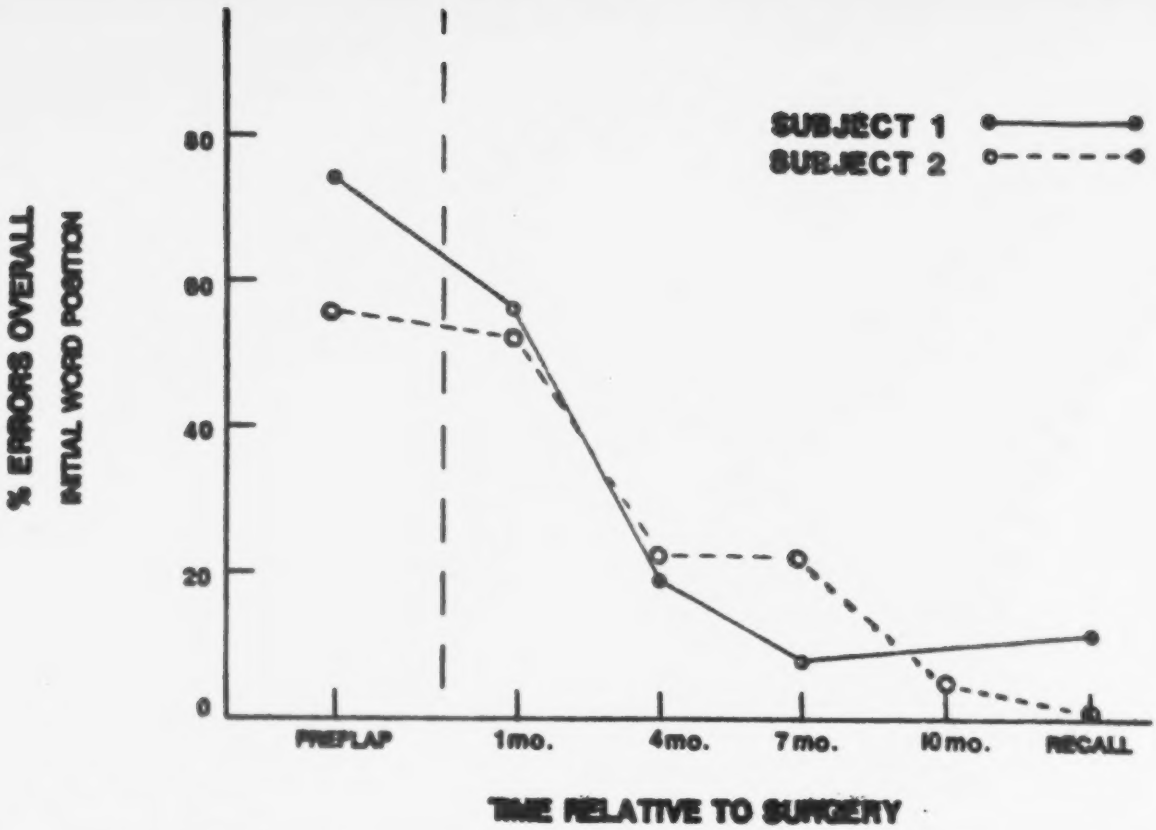
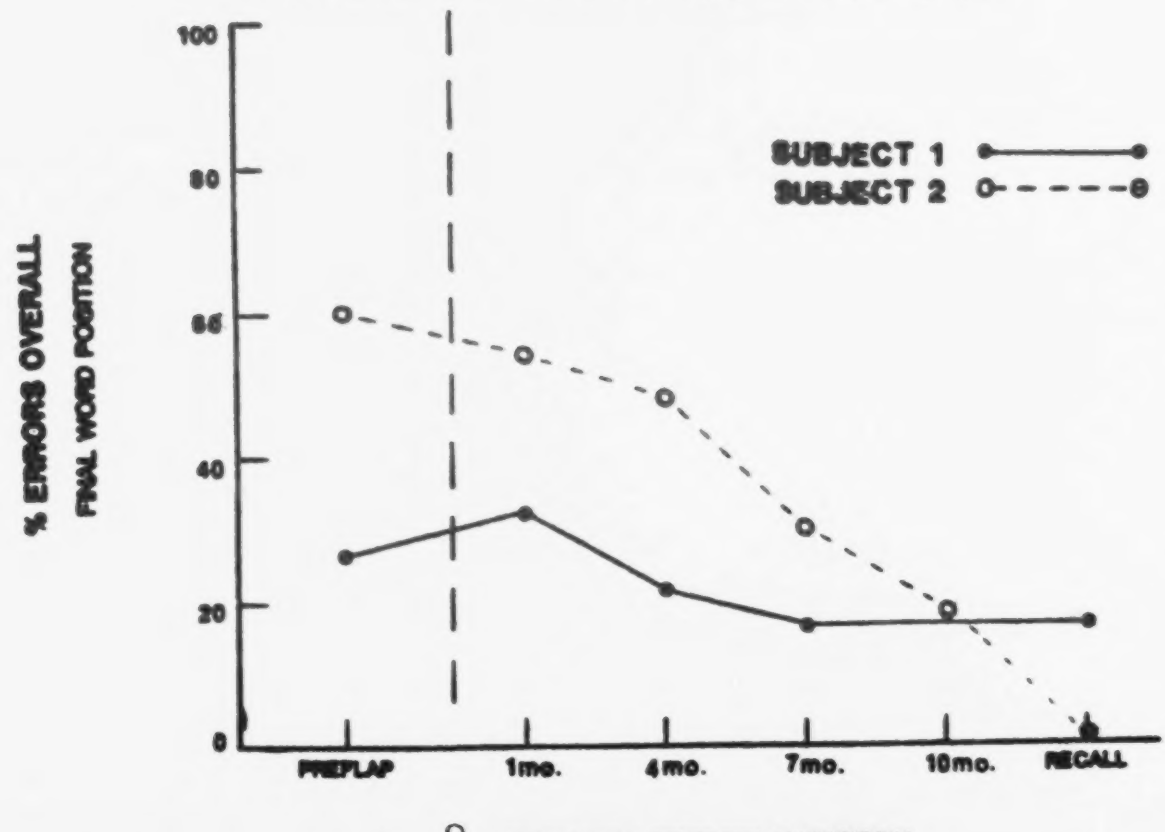


Figure 1. Overall error rate for word-initial phonemes in the speech of tw children before and after pharyngeal flap surgery.

Figure 2. Overall error rate for word-final phonemes in the speech of two children before and after pharyngeal flap surgery.



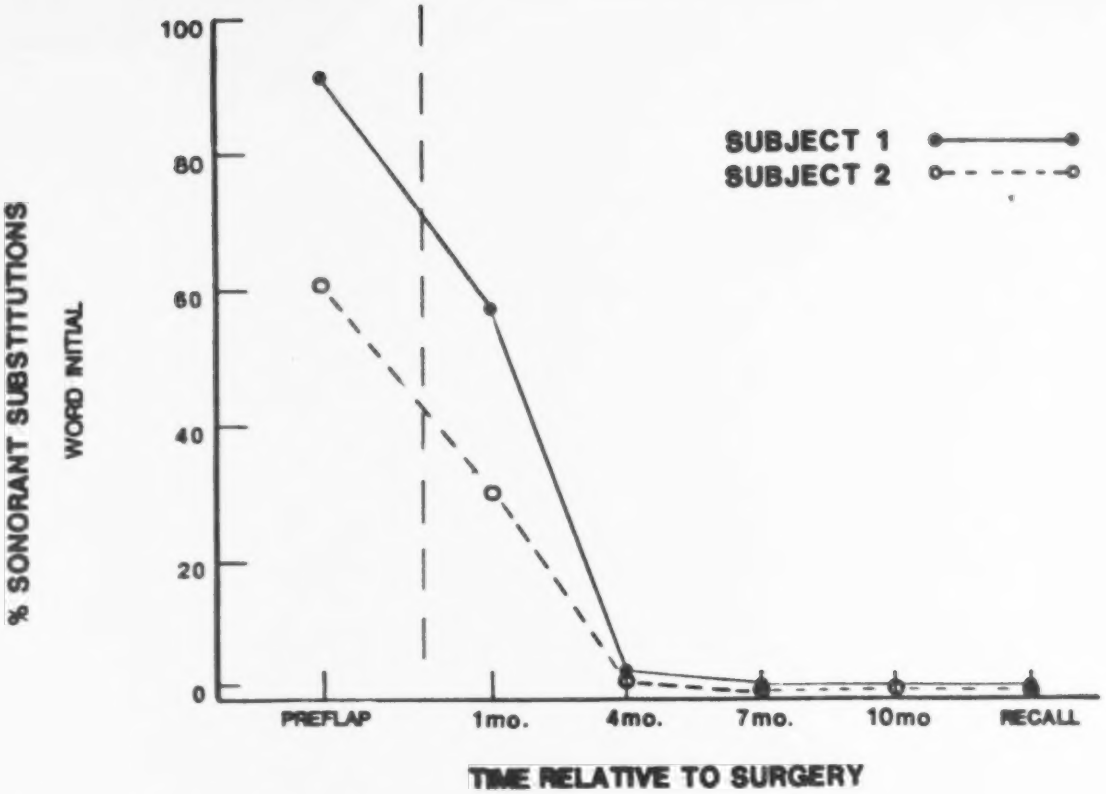
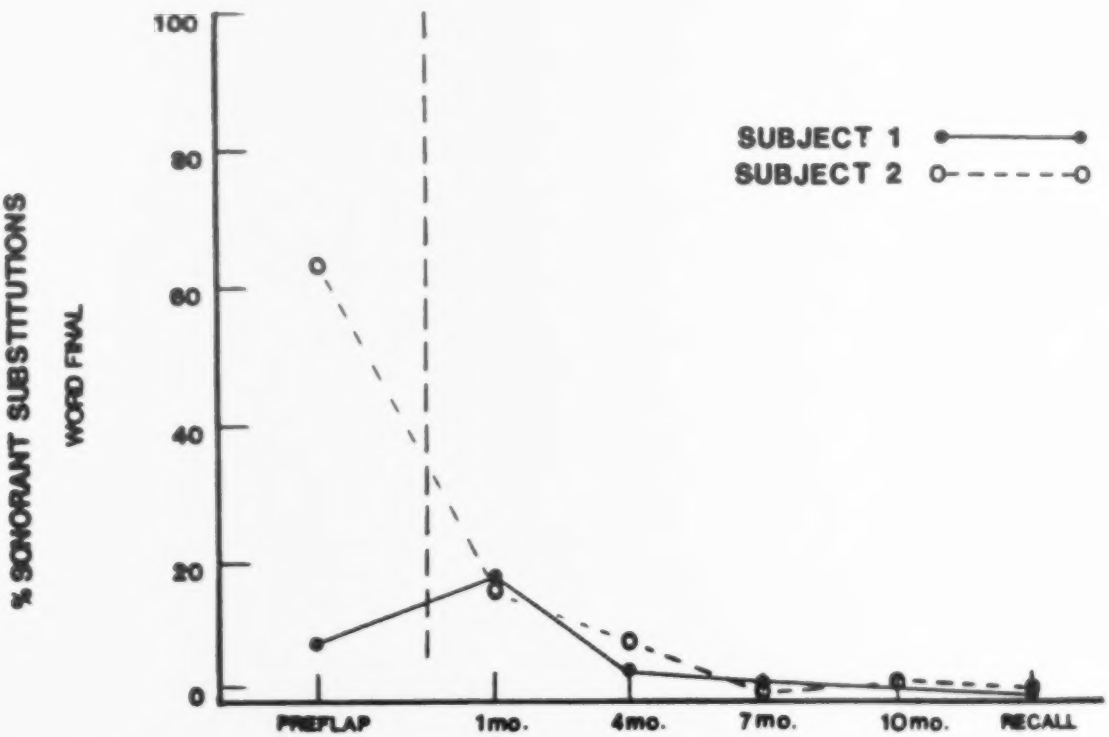


Figure 3. Percent of sonorant substitutions for non-sonorant consonants word-initially.

Figure 4. Percent of sonorant substitutions for non-sonorant consonants word-finally.



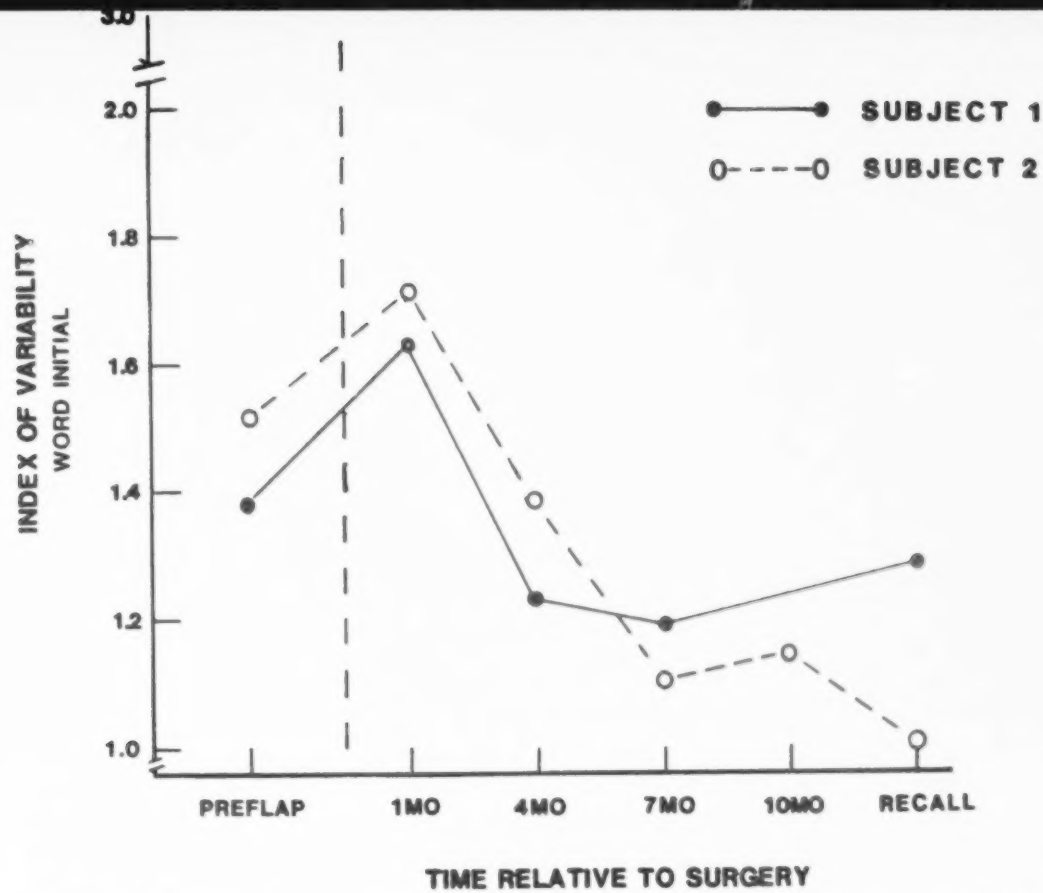


Figure 5. Index of variability for word-initial consonants where 3 indicates that an average of three different phonemes were produced in three attempts at a single phoneme, 2 indicates two different phonemes produced in three attempts, and 1 indicates that all of the attempts at a single phoneme were the same.

Figure 6. Index of variability for word-final consonants (1, 2, & 3 are indicated as in Figure 5).